FEBS Letters 584 (2010) 1633

ELSEVIER

FEBS Letters

journal homepage: www.FEBSLetters.org

Preface

Frontiers in membrane biochemistry

The aim of this issue entitled "***Frontiers in Membrane Biochemistry***" is to present the different aspects in this research field dealing with both the role of individual membrane components and basic physical, biochemical and cell biological principles inherent to cellular membrane functioning.

Membranes are stable structures whose components have different degrees of lateral motility. They provide a physical boundary that allows a continuous exchange of information between the inside and outside worlds. The organization of membranes is much more complex than that proposed by Singer and Nicolson [1], where proteins were floating in a sea of fluid lipids. Components of biological membranes are arranged following a non-homogenous lateral distribution, leading to the formation of domains with a highly differentiated molecular composition and super-molecular architecture that are stabilized by interactions between components. Macro-domains of micron size are morphologically evident in the biological membranes of polarized cells. However, sub-micron and nanometer scale domains are also present in biological membranes. This is indicated by the observation that even in membrane regions lacking a morphologically distinguishable architecture, sphingolipids and proteins form defined clusters that cannot undergo free and continuous lateral diffusion, but rather are transiently confined to micro-domains [2]. These properties were first discussed in association with Golgi and plasma membranes, but now several reports suggest that they are characteristic of all cell membranes.

Probably the most studied membrane domains are "lipid rafts": membrane domains defined by their sphingolipid- and cholesterol-rich nature, that have an enrichment in GPI-anchored proteins and membrane-anchored signal transducer molecules such as the Src family kinases Lyn and c-Src [3]. These membrane domains display a large range of sizes with a diameter of between 5 nm and 300 nm, depending on the fixation and measuring methods. However, several observations suggest that not necessarily all these molecules belong to the same domain and that glycosphingolipid-enriched domains are different from those enriched of GPI-anchored proteins or from caveolar domains.

In the section *Lipid Micro-domains* the topic of "membrane rafting" is intensely discussed along with the chemical and physical basis of the stability of lipid raft micro-domains, their role in membrane polarity, and the synthesis, sorting and function of their components. In the section *Membrane Organization* the reader finds a survey of recent observations on topology and organization of specific membrane components as well as their interactions and assembly within various membranes including those of the nervous system. In *Membrane Shaping and Dynamics* the authors address the physicochemical features of amphipathic helices and membrane shaping proteins and how cooperative elastic stress and hydrophobic attraction may influence membrane deformation and architecture. Finally, in *Membrane Function and Disease* much attention is paid to the class of sphingolipids, e.g. their role in membrane remodeling and their implications in various diseases.

Taken together, these "***Frontiers in Membrane Biochemistry***" offer the reader the opportunity to absorb the current knowledge on molecular cell biology of membranes and to be trans-guided over the border to innovation.

References

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Available online 24 February 2010

doi:10.1016/j.febslet.2010.02.059